

iD

Operators Manual



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TABLE OF CONTENTS

FOREWARD 1

1.0 INTRODUCTION 1

 1.1 Options 1

 1.2 Test Reports 1

DIGITAL SYSTEM 2

2.0 THE KEYS AND THEIR FUNCTIONS 3

 2.1 Setup Key 3

 2.2 Number Keys 3

 2.3 Enter Key 3

 2.4 CLR Key 3

 2.5 Cancel Key 3

 2.6 Sample ID Key 3

 2.7 Tare Key 3

 2.8 Arrow Keys 3

 2.9 Date & Time Key 4

 2.10 Print Key 4

3.0 THE SET UP MENU 4

 3.1 Engineering Units 4

 3.2 Sample Type 5

 3.3 Sample Break 5

 3.4 Test Report Options 6

 3.5 Print Options 7

 3.6 Rate Options 8

 3.7 Peak Load 8

4.0 HOW TO ENTER A SAMPLE IDENTIFICATION CODE 8

5.0 TEST SETUP 9

6.0 CALIBRATION 12

6.1 5 POINT LINEAR CALIBRATION 19

7.0 STATEMENT OF WARRANTY 22

FOREWORD

This section of the manual is designed to provide instructions on the set up of the iD digital indicator. Please take a few moments to read through it and become familiar with the operation. If you require technical support, please call us.

1.0 INTRODUCTION

Standard information displayed on the indicator are peak load, peak stress, rate of load and if activated, average rate of load applied to a sample during a test.

1.1 Options

Optional information is user selectable and will be included on the standard test report, if activated. Test report options are described in detail in section 3.4 of this manual

1.2 Test Reports

Test reports can be optionally stored to memory, printed on an optional printer or downloaded to a computer with an optional download program. Details for all options can be found in the following pages.

THE DIGITAL SYSTEM

2.0 THE KEYS AND THEIR FUNCTIONS

2.1 SETUP Key

The Setup key is a soft key, used to open and display a list of all menus for test setup functions.

2.2 NUMBER Keys

The Number keys are used to select and open an individual menu option and to input a numerical value into a data entry field.

2.3 ENTER Key

The Enter key is used to accept and set a numerical value into the data entry field of any menu option. It is also used in the calibration procedure.

2.4 CLR Key

The Clear key is used to backspace the cursor to erase an incorrectly set character in a data entry field, and allow additional data entry into the field.

2.5 CANCEL Key

The Cancel key is used to clear all characters in a data entry field and close a prompt without entry of data. Note: Data must be reset in cleared prompt for menu to function.

2.6 SAMPLE ID Key

The Sample ID soft key is used to open a prompt for entering an individual test sample identification code into memory.

2.7 TARE Key

The Tare key is used to set a new zero load status by nullifying all tare weight associated with floating the machines piston by moving it off its mechanical stops. It also clears displayed test results from the buffer and initializes the indicator for the next test. If machine is equipped with overload protection, press the TARE key to restart pump motor.

Note: Make sure all displayed test data is documented before pressing the Tare key, as all displayed test data will be lost.

2.8 ARROW Keys

The Arrow Keys are used to switch the indicator between active calibration scales when the indicator is being used with multiple transducer/load cell combinations or when it is being used to control an additional auxiliary load frame. They are also used when setting an alphanumeric

sample identification code, changing time and date, and in the calibration program.

2.9 DATE & TIME Key

This soft key is used to open the menu for changing the time and date.

How to set:

- Press Setup soft key to open option and display prompt.
- Press Time/Date soft key to display time and date on the screen.
- The characters values contained inside the highlighted box can be increased or decreased in value by pressing the Up/Down scroll Arrow keys.
- To move highlighted box press Right/Left scroll Arrow keys and repeat procedure to adjust values.
- When correct values are set press the Cancel key to enter.
- Press the Exit key to return to the testing screen.

2.10 PRINT Key

The Print key can be used to print a report of the current test displayed on the indicators screen.

Note: See print options in Setup Menu for additional Printing and Transfer functions.

3.0 THE SETUP MENU

Press the Setup soft key to display setup menu options of:

1. Engineering Units
2. Sample Type
3. Sample Break
4. Test Report Options
5. Print Options
6. Rate Options
7. Peak Load

3.1 Engineering Units

Pressing the “1” key, Engineering Units from the main Setup Menu displays options:

- 1) Load,
- 2) Stress and
- 3) Size by their individual types.

Load Units – press “1” key to display menu options. To select required load unit press appropriate menu number key. Press Exit key to return to Engineering Units menu.

Stress Units – press “2” key to display menu options. To select required stress unit press appropriate menu number key. Press Exit key to return to Engineering Units menu.

Size Units – Press “3” key to display menu options. To select required size unit press appropriate menu number key. Press Exit key to return to Engineering Units menu.

To return to the Setup Menu, press the Exit key.

3.2 Sample Type

Pressing the “2” key Sample Type from the main Setup Menu displays options:

1) Cylinder; 2) Cube, 3) Beam Third Point, 4) Beam Center Point, 5) Cross Sectional Area and, 6) Cylinder Split in Tension.

Press the number key 1 through 6 to select the sample type and open the menu to set the required sample dimensions. Note: Current dimensional settings will be displayed; if values are correct, press Exit key to return to the Sample Type menu. To change displayed dimensional values press appropriate number key on the menu for prompt, which is displayed in a box on the lower left hand side of screen.

Example: Press “1” Cylinder, to select and open menu options “1” Diameter or “2” Length to change dimensional values. Press “1” key for diameter prompt, enter required values through number keys, press Enter key to set values. Press “2” key for length prompt, enter required values through number keys, press Enter key to set values. Press Exit key to return to Sample Type menu.

Note: If a character was entered incorrectly, press the CLR key to backspace the cursor one character at a time, then enter correct character value and press Enter key to set.

3.3 Sample Break

The Sample Break feature has two independent operating functions of Load Threshold value and Sample Break yield strength break percentage.

Load Threshold is the load value setting at which the Rate of Loading function becomes activated and is displayed on the indicators screen. Its factory default setting is 500 lbs. or metric equivalent. The threshold value setting should be set in the load unit type in which the indicator will be operated in: e.g. lb., kN, etc. See section 3.1 “Engineering Units” load unit type, for setup instructions.

Note: The threshold function will not accept a load value setting below 100 lbs. or its metric equivalent.

Sample Break is defined as a percentage of sample yield strength and functions to define the end of a test. When activated the indicator will display both the peak load applied to the test sample and the samples peak stress value.

Note: The factory default setting is 50 percent.

How to Set

Press the “3” key Sample Break from the main Setup menu to display options of:

1) Load Threshold Value and 2) Sample Break Percentage.

Load Threshold – press “1” key to select and open prompt. Change the current value setting through number keys and press Enter key to set.

Sample Break – press “2” key to select and open prompt. Change the current value setting through number keys and press Enter key to set.

Example: If sample break percentage setting is 25% and the maximum peak load applied to the test sample is 100,000 lbs. (444.8 kN), the indicator will terminate the test when the internal load value falls below 75,000 lbs. (333.6 kN), or 25% of the applied peak load.

Note: Setting a low value percentage of 5% or less may cause the indicator to prematurely end a test.

3.4 Test Report Options

Pressing the “4” key Test Report Options from the main Setup menu will display the following list of report options.

1. Operator ID Number
2. Cylinder Break Type
3. Cylinder Correction Factor
4. Cylinder Cap Type
5. Sample Age
6. Sample Weight
7. Average Rate of Load
8. Auto Store

The test data for an option will be included on the standard test report if activated. The information listed on a Standard Test Report includes: Test Date, Time, Identification Code, Sample Type, Sample Length, Sample Area, Peak Load and Peak Stress.

Operator I.D. Number – press “1” key from the options menu to toggle between OFF/ON. When activated, at the prompt enter the Operator ID number and press Enter key to set. Once set, the ID number will be added to the test report until changed or toggled to OFF position.

Cylinder Break Type – press “2” key from the option menu to toggle between OFF/ON. When activated at the end of a cylinder test, a list of cylinder break type patterns as listed in ASTM C-39, part 7.4, figure 2 will be automatically displayed. To select and store a break type, press appropriate menu number key to select and store.

Cylinder Correction Factor – press “3” key from the option menu to toggle between OFF/ON. When activated function automatically corrects peak stress value of a test cylinder to ASTM C-39, part 8.2, if cylinder length to diameter ratio is 1.75 or less. Function requires that the correct cylinder diameter and length must be entered into the cylinder sample type menu in order to function correctly. Cylinder diameter and length should be verified before the start of each test if option is activated.

Note: Option should be deactivated after conclusion of correction factor testing to eliminate the unnecessary storing and printing of empty data fields.

Cylinder Cap Type – Toggle option ON by pressing the “4” key from the option menu which displays the Cap Type option menu list. To set required type press appropriate number key, and the word “Selected” is then displayed on cap type menu line.

Press Exit key to set and return to Test Report menu.

To change selected cap type toggle option OFF and repeat procedure above.

Sample Age – Toggle option ON by pressing the “5” key from the option menu, which also displays the Age Units option menu list. To select required time units, press number 1 or 2 key and the word “Selected” is then displayed on age unit menu line.

Press Exit key to set and return to Test Report menu.

How it functions:

After entering the Sample ID code at the start of a test, an age prompt D = Day, H = Hour will require user to enter a numerical Time Unit value. Press number keys to set required units, and press the Enter key to store.

Note: The prompt will appear at the start of each test and will remain active until turned OFF.

Sample Weight – press “6” key from the option menu to toggle between OFF/ON. Press Exit key to return to Test Report menu.

How it functions:

After entering the Sample ID code at the start of a test, a Weight prompt will require user to enter a numerical value for sample weight. Press Number keys to set required weight, and press Enter key to store.

Note: The prompt will appear at the start of each test and will remain active until turned OFF.

Average Rate of Load – Press “7” key from the option menu to toggle between OFF/ON.

How it functions:

When activated, at the end of a test the Loading Rate applied to the test sample is averaged over the duration of the second half of the test, and is automatically displayed at the end of the test.

Note: Auto-store must be turned ON to store rate data to memory.

Auto-Store – press “8” key from the option menu to toggle it between OFF/ON.

The Auto-Store Function must be activated in order to input a Sample Identification Code, and store it to memory along with all other test data information from optional test report functions which will be activated automatically at the start and end of a test.

Press Exit key to return to testing screen.

3.5 Print Options

Pressing the “5” key Print Options, from the Setup Menu displays a list of print and transfer options.

1. Print Last Test, press “1” key to print.
2. Print All Stored Tests, press “2” key to print.
3. Print Individual Test, press “3” key at the prompt, enter Sample ID Code and press Enter key to print.
4. Send Last Test to PC, press “4” key to transfer
5. Send All Stored Tests to PC, press “5” key to transfer
6. Send Individual Test to PC, press “6” key. At the prompt enter Sample ID code and press Enter key to transfer.
7. Clear Transaction Database, press “7” key. At the prompt, press YES key to clear memory or

press NO key and Exit key to return to menu without clearing memory.

Press Exit key to return to option menu.

Note: Printer and Transfer Program are optional and must be purchased separately. Please contact us for further information.

3.6 Rate Options

Pressing the “6” key Rate Options from the main Setup Menu will display options:

1) Load Minutes, 2) Load Seconds 3) Stress Minutes and 4) Stress Seconds.

To select required monitoring type press appropriate number key. Press Exit key to return to menu. During the test, the rate of loading will be displayed in the time units selected, and the load or stress in the unit previously selected in the Engineering Units option menu.

3.7 Peak Load

Load values are displayed on the top line of the indicators screen.

Peak Load Function – pressing the “7” key from the main Setup menu toggles the peak hold function ON/OFF.

Peak Load ON – when activated, this function holds the maximum load value applied to the sample during a test on the indicators display screen until the Tare key is pressed at the start of a new test.

Peak Load OFF – This function deactivates the peak hold function and allows the displayed load value to decrease and return to a zero load value when the machines control valve is placed in the retract position.

Note: The Peak Stress Hold function cannot be deactivated.

Press Exit key to return to testing screen.

4.0 HOW TO ENTER A SAMPLE IDENTIFICATION CODE

Sample Identifications can be stored in memory as either a numerical code or as an alphanumeric code. The indicator’s Auto-Store function must be turned ON in order to enter an identification code and store it to memory.

How to Set a Numerical Identification Code

Press the Sample I.D. key. At the prompt press the number key 0 through 9 to set required characters, which are displayed on the lower left hand side of the indicators screen. After all numbers are set, press the Enter key to store.

If additional test report options are turned ON, user may be prompted to enter additional test data at this time. Example: sample age.

How to Set an Alphanumeric Identification Code

Press the Sample ID key. At the prompt press the Up Scroll Arrow key. The alphabet and position cursor are now displayed. Use the Scroll Arrow keys to position the cursor on the required character and press Enter key to set. To set a numerical character, press number 0 through 9 keys to set. Once required identification code is set, press Down Arrow key until cursor is positioned next to identification code and press Enter key to store.

Note: If a mistake is made when entering an identification code character, press the CLR key to backspace the cursor one character at a time. Follow the same procedure to set correct character. Pressing the Cancel key will clear all set characters. Repeat procedure to set and enter correct code.

5.0 TEST SETUP

This section describes how to setup the indicator to conduct a test.

Step 1: If the indicator is factory installed on a Test Mark compression testing machine it should be ON when the machine is connected to an electrical power source. If display is dark, plug indicator power supply cord into outlet box located behind indicator on its frame-mounting bracket.

The indicators electrical voltage requirements are listed on its serial number tag on the back of the indicator. If the indicator is being used as a retrofit installation, plug power supply cord into a wall outlet with electrical power supply source compatible with indicator. The indicators supply cord serves as the power disconnect. The power outlet supplying the indicator must be installed near the indicator and be easily accessible.

Allow the indicator to warm up for 15 – 20 minutes before beginning a test or calibrating it.

Note: The indicator has NO ON/OFF switch. Normal procedure is to allow indicator to remain ON for 24 hours a day.

Step 2: Press Setup key and verify that all menu option items are correctly set.

Engineering Units – check and set required counting units.

Sample Type – check and set sample type and dimensions.

Sample Break – see Setup Menu section 3.3 for instructions.

Test Report Options – Set option menu items OFF/ON as required for test documentation on indicator screen and for hard copy test documentation.

Auto-Store must be ON to store data to memory.

Rate Options – check and set required load rate units.

Peak Load – check and set peak load function ON.

Step 3: If the indicator is supplied with more than one calibration scale, the activated scale and its number will be displayed in the upper right hand corner of the display screen. Toggling the Up Arrow key switches the indicator between its calibration scales.

If the indicator is unplugged or loses power, it will always default back to scale 1.

Always review all test setup menu settings whenever the indicator is switched between calibration scales to avoid errors in your testing program. The calibration scale number must be verified before starting a test to avoid testing errors as erroneous test results can not be corrected. If machine is equipped with overload protection, press the TARE key to restart the pump motor.

Step 4: Auto-Store – If required turn option ON. Test results will be stored in memory automatically at the end of each test. See section 3.4.

- Step 5: Clear stored test results IF your test documentation program requires clearing stored results from memory before storing new test data. Note: If stored test results are IMPORTANT, print or transfer before clearing as cleared data is non-retrievable. See Setup Menu option “5”, section 3.5 Print Options for instructions.
- Step 6: Set hydraulic loading control valve in its Retract position and turn hydraulic pump on. Insert and center test sample in testing machine.
- Step 7: Sample ID Number – if required, press Sample ID key and input required sample identification code and press Enter key to set. User may be required to input optional test data at this time.
- Step 8: To start test, use hydraulic load control valve to advance the machines piston to the desired starting position, normally a point when an air gap of 1/16” (1.5 mm) or less is between the top of the test sample and bottom of upper test platen. Place control valve in Hold position. Press indicators Tare key to remove all residual load values on indicators screen. The top load position line of the indicator will display all “0’s” load value indicating it is ready to start. The indicator will display the following data on its display screen during a test:

Line 1: Sample load value
Line 2: Sample stress load value
Line 3: Rate of load being applied to the test sample

- Step 9: Many ASTM test procedures permit a higher rate of loading or a preload to be applied to a test sample at the beginning of a test. Review the applicable ASTM standard for the required Rate of Loading procedure for the sample type and size you are testing.

Shift control valve lever to Full Advance position. At sample contact, the top line of the screen will change and show a rapid increase in the load being applied to the test sample. When required preload value is reached, shift control valve lever to Metered Advance position.

The third line of the display is now showing the current live Rate of Loading being applied to the test sample. To adjust and set the required loading rate, slowly turn the knob on the control valve clockwise to decrease loading rate and counter clockwise to increase loading rate. All changes in loading rate are updated live on the display screen.

Once the required rate of loading has been established continue to monitor the display screen making any necessary adjustments to loading rate as needed.

Note: Because of the compressive nature of the materials used in unbonded pad caps, it may be difficult to set and maintain a controlled rate of loading with an applied load value of less than 20,000 lbs. (88 kN) when testing concrete cylinders.

- Step 10: End of test – as the test samples ultimate load is being approached the rate of loading value will begin to decrease due to cracking in the test sample. Make no adjustments in the loading rate when this occurs.

As the test sample yields the displayed Load and Stress values will freeze and no longer increase in value, when the indicator detects that the load has fallen below the set sample break percentage. The samples peak load and stress values will be displayed and the displayed load rate will fall to a -0- value. After it has displayed a -0- value for several seconds, shift the control valve lever to the

Retract position.

Step 11: Information displayed at the end of a test:

Line 1: Peak Load Value
Line 2: Peak Stress Value
Line 3: Zero Load Rate
Line 4: If activated, Average Loading Rate

The indicators normal operating procedure at the end of a test may be affected by the activation of optional menu items. This will cause the indicator to request additional test data, which will require you to input the data before the final test results can be displayed and stored to memory.

If manually documenting test results, record information before starting a new test. When the Tare key is pressed, displayed test results will be LOST.

TECHNICAL SUPPORT

If a problem should occur with your testing machine:

- ✓ Check to see if cables are properly connected.
- ✓ Second, call Test Mark for technical support at 800-783-3227 or 330-426-2200 (8 AM to 4 PM EST Monday through Friday)

A LOAD CELL EQUAL TO OR GREATER THAN THE CAPACITY OF THE MACHINE IS REQUIRED FOR CALIBRATION. CALIBRATION SHOULD BE PERFORMED BY A CERTIFIED CALIBRATION COMPANY.

6.0 CALIBRATION

Step 1: Allow digital to warm up for at least 20 minutes.

Step 2: Before attempting to calibrate the machine, please verify the accuracy. All new machines are shipped from the factory with a calibration stored in the digital indicator.

Step 3: Pivot the digital so that the bottom is facing you. Remove the large Phillips head screw located on the bottom left corner.

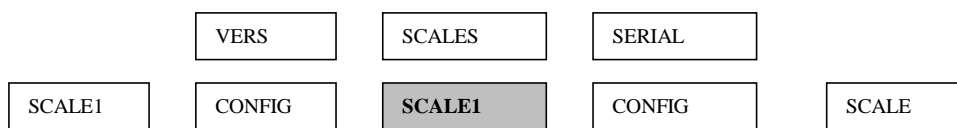
Step 4: Using a pen or a small screwdriver, press the button located in the hole where the screw was just removed. This displays the “SCALE CONFIGURATION” menu. “SCALES” will be highlighted.



SCALE CONFIGURATION

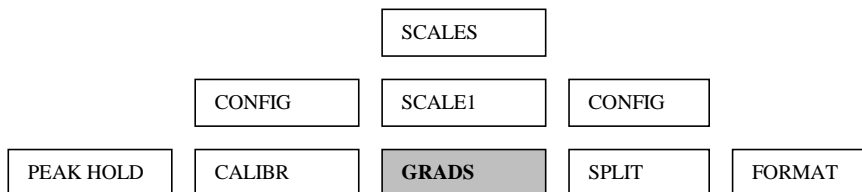
Step 5: Press the down arrow key once. This displays the “SCALE1 CONFIGURATION” menu. “SCALE1” will be highlighted. For multi channel calibration, select Scale 1, Scale 2, Scale 3 or Scale 4 for calibration of that channel.

** NOTE: The ID digital defaults to Scale 1 when you exit the calibration program. Select the proper channel with the arrow keys.



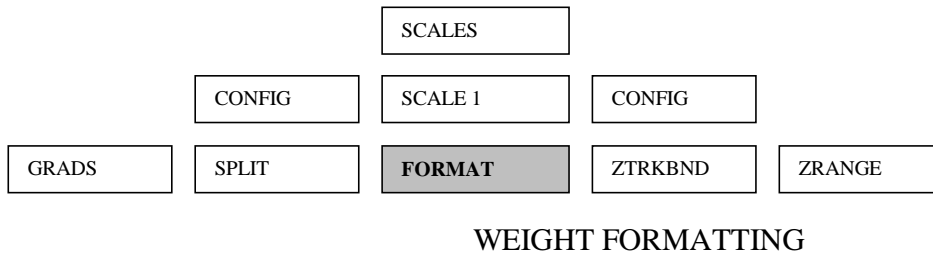
SCALE1 CONFIGURATION

Step 6: Press the down arrow key once. This displays the “FULL SCALE GRADUATIONS” menu. “GRADS” will be highlighted.

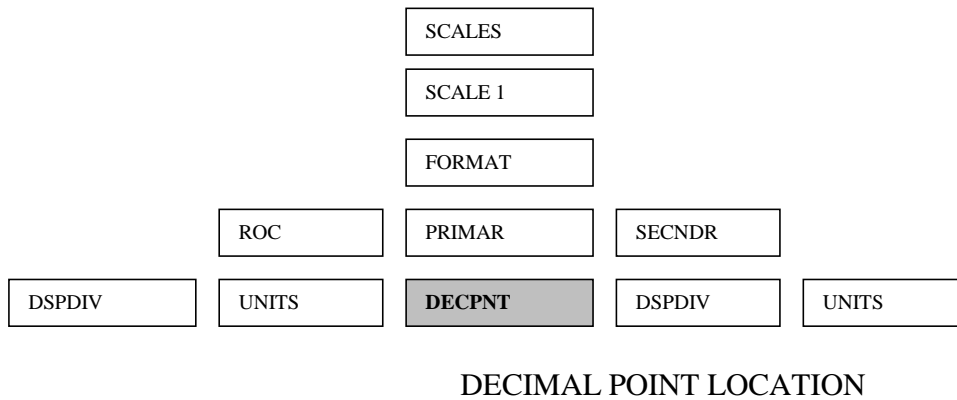


FULL SCALE GRADUATIONS

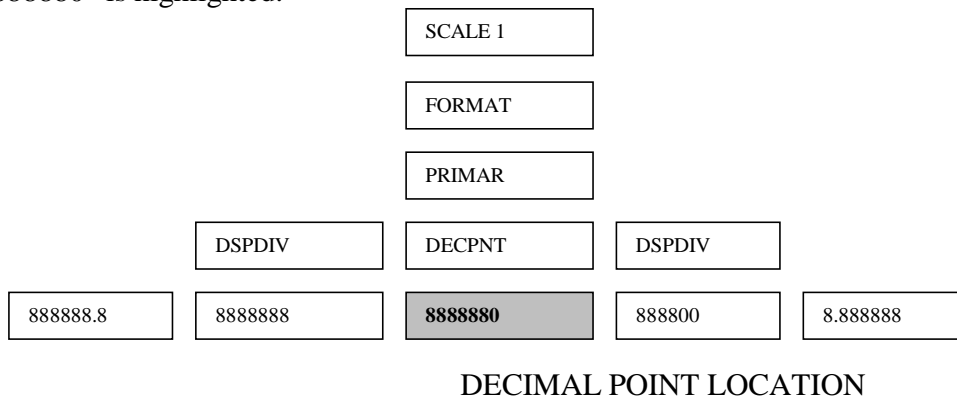
Step 7: Press the right arrow key 2 times until “FORMAT” is highlighted.



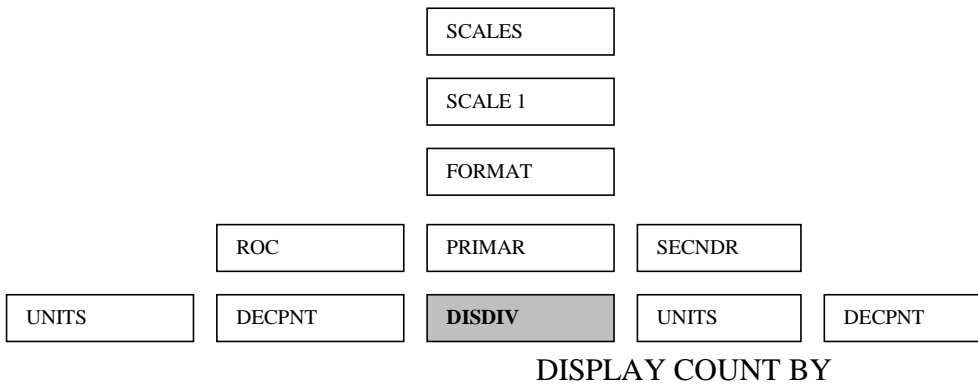
Step 8: Press the down arrow key 2 times until “DECPNT” is highlighted.



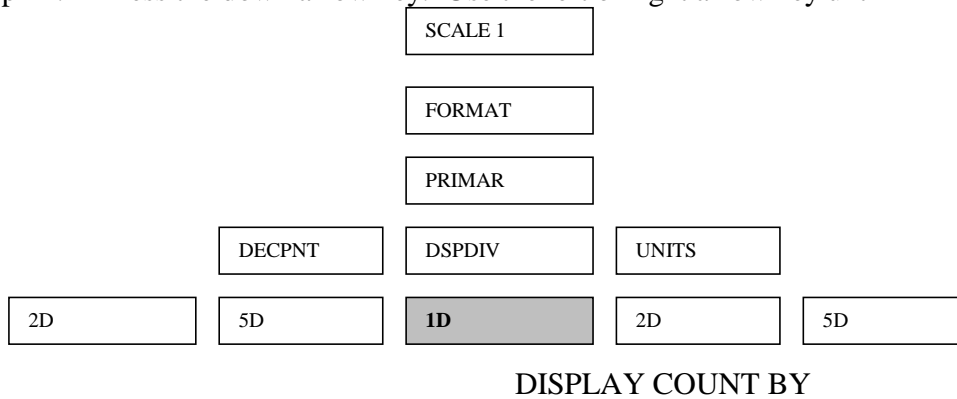
Step 9: Press the down arrow key 1 time. Press the left or right arrow key until “8888880” is highlighted.



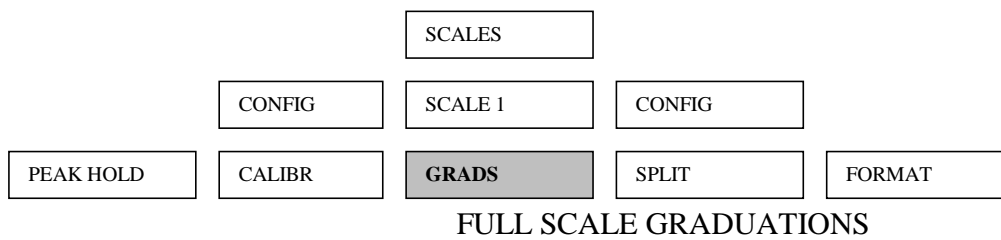
Step 10: Press the enter key. The display will shift back to step 8. “DECPNT” should be highlighted. Press the right arrow key until “DSPDIV” is highlighted.



Step 11: Press the down arrow key. Use the left or right arrow key until “1D” is highlighted.

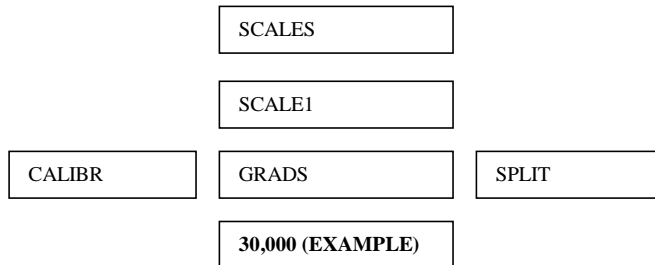


Step 12: Press the enter key. The display will shift back to the same as in step 10. Press the up arrow key 2 times until “FORMAT” is highlighted. Press the left arrow key 2 times until “GRADS” is highlighted.



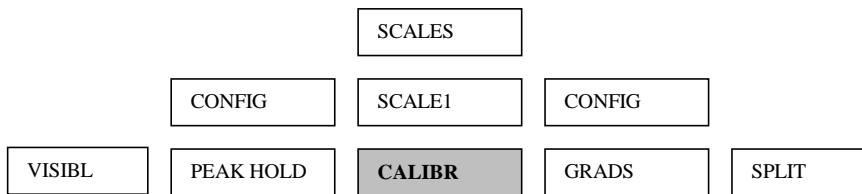
Step 13: Press the down arrow key 1 time. Take the full scale of the testing machine and divide it by 10. Enter that number manually and press the enter key.

Example: $300,000 \div 10 = 30,000$



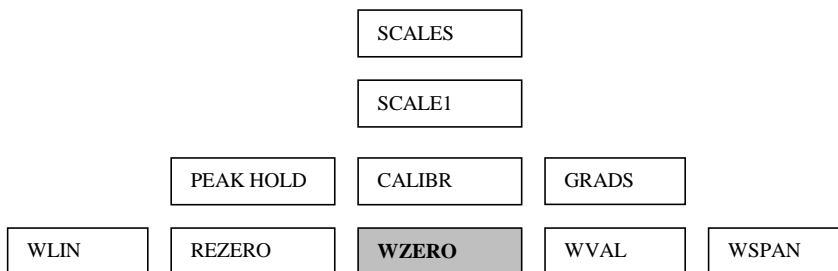
FULL SCALE GRADUATIONS

Step 14: Press the left arrow key 2 times. "CALIBR" will be highlighted.



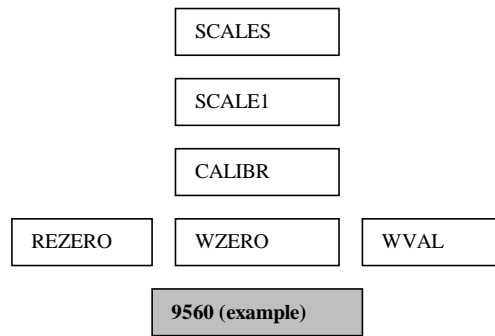
SCALE CALIBRATION

Step 15: Press the down arrow key once. This displays the "DEADLOAD CALIBRATION" menu. "WZERO" is highlighted.



DEADLOAD CALIBRATION

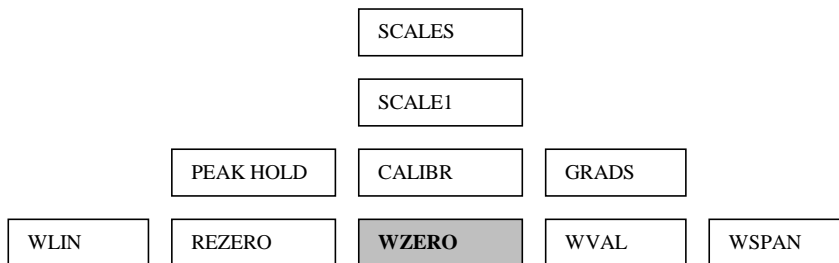
Step 16: “WZERO” is where you set the ZERO calibration point. Press the down arrow key. The highlighted box represents the A/D count for ZERO load value.



DEADLOAD CALIBRATION

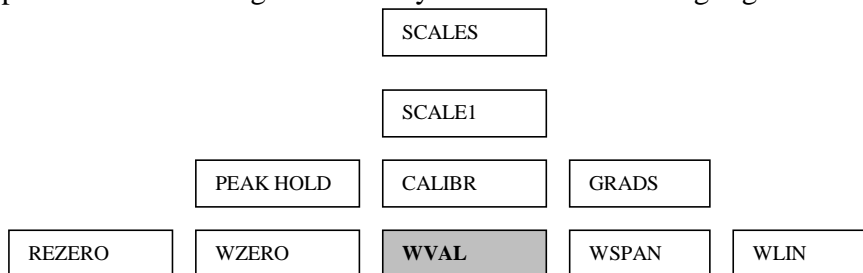
Step 17: Float the piston approximately 3/16” (4.7 mm). Put the control valve in the metered advance position with the flow control valve open approximately half a turn. Press the “CALIBRATE” soft key along the bottom of the display. The display reads “CALIBRATING ...” DEADLOAD CALIBRATION for several seconds. When the word “CALIBRATING...” disappears from the screen, a new A/D count will appear in the highlighted box. The Zero calibration point and corresponding A/D count have now been stored.

Step 18: Press the Up Arrow key. This returns the display to the “DEADLOAD CALIBRATION” menu. “WZERO” is highlighted.



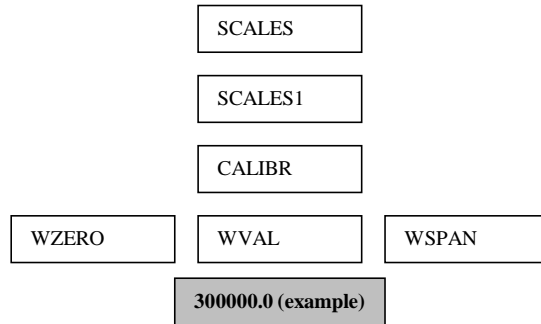
DEADLOAD CALIBRATION

Step 19: Press the Right Arrow key. “WVAL” is now highlighted.



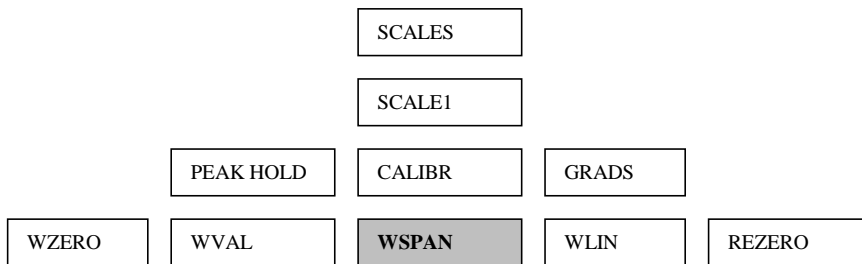
TEST WEIGHT VALUE

Step 20: WVAL represents FULL SCALE or the capacity of the machine. To enter full scale, press the down arrow key.



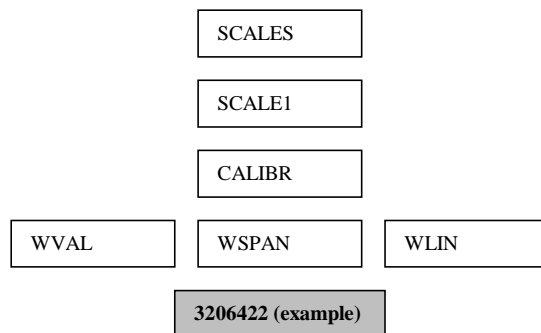
TEST WEIGHT VALUE

Step 21: Use the keypad to enter the FULL SCALE or CAPACITY of the machine. Press the Enter key to accept the value. The display will say “Value Accepted” and will shift to the “SPAN CALIBRATION” menu. “WSPAN” will be highlighted.



SPAN CALIBRATION

Step 22: Press the Down Arrow key. The highlighted box represents the A/D count for FULL SCALE load value.



SPAN CALIBRATION

Step 23: Run the machine up to full capacity. Once full capacity has been reached, press the “CALIBRATE” soft key along the bottom of the display. The display reads “CALIBRATING ...” SPAN CALIBRATION for several seconds. When the word “CALIBRATING...” disappears from the screen, a new A/D count will appear in the highlighted box. The FULL SCALE calibration point and corresponding A/D count have now been stored.

Step 24: Press the Up Arrow key until “SCALE 1” is highlighted. Press the Save and Exit soft key located along the bottom of the display. The display will now read “*STANDBY* SAVING CONFIGURATION”, and then will return to the testing screen.

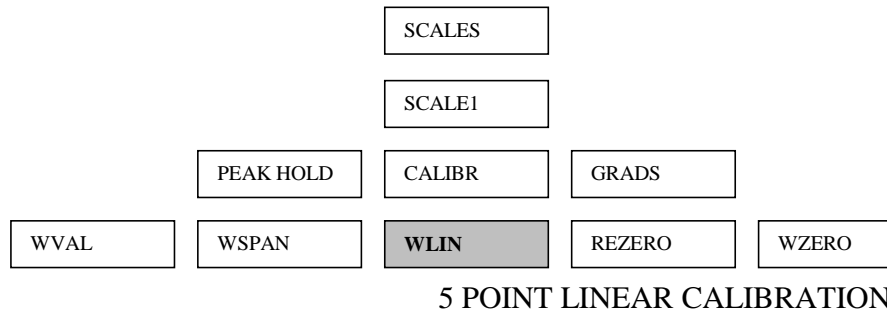
Done. Ready to verify calibration.

To verify calibration accuracy, load machine to specific load points and compare the reading on the Indicator with those of the load cell standard.

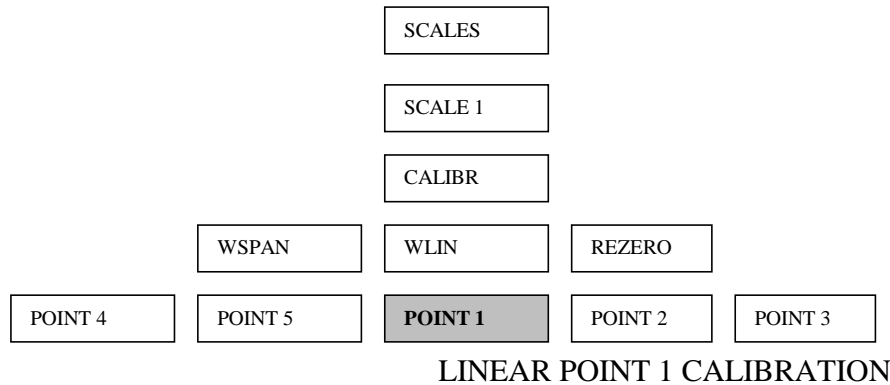
6.1 5 POINT LINEAR CALIBRATION

After setting “0” and FULL SCALE and verifying the calibration, adjustments to the calibration can be made in the 5 Point Linear Calibration program. To access the Linear Calibration program, repeat Calibration Instructions steps 1 through 7. “WZERO” will be highlighted.

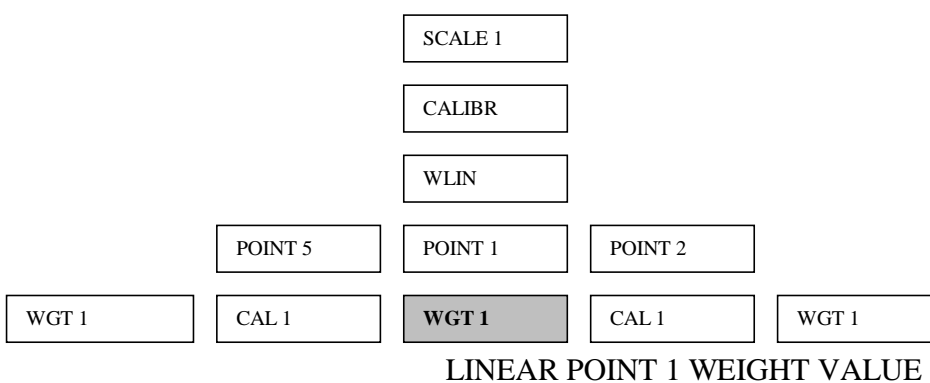
Step 1: Press the Left Arrow key 2 times until ‘WLIN’ in highlighted.



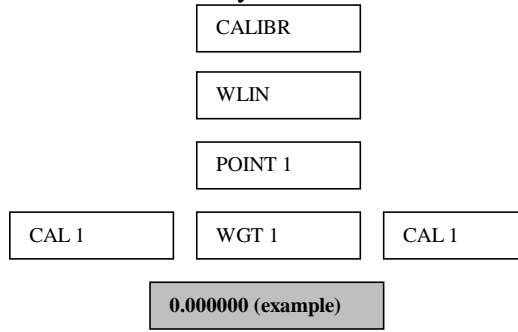
Step 2: Press the Down Arrow key. “POINT 1” will be highlighted.



Step 3: Press the Down Arrow key. “WGT 1” will be highlighted.

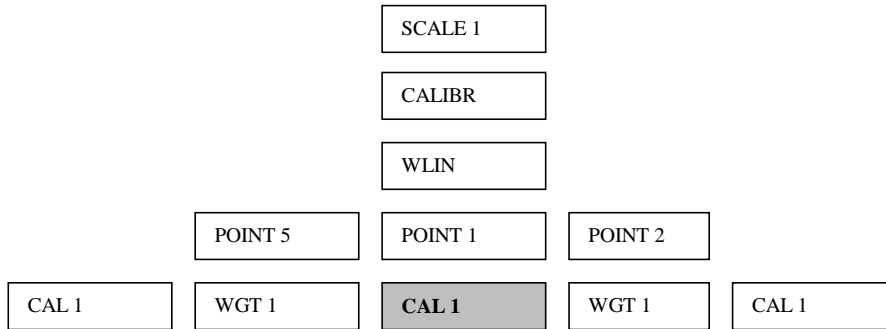


Step 4: Press the Down Arrow key. The numbers in the highlighted box represent Point 1 value.



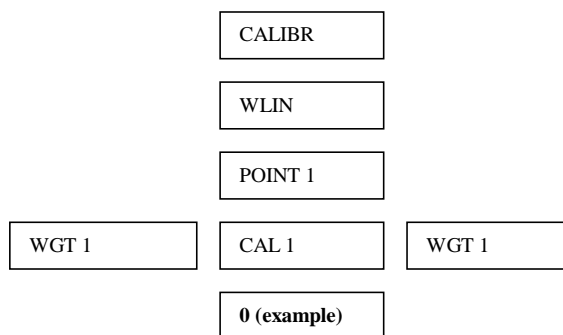
LINEAR POINT 1 WEIGHT VALUE

Step 5: Using the Number keys, enter the value for the first calibration point. Press the Enter key to set the value. The display will read “Value Accepted” and “CAL 1” will be highlighted. Note: You can not use “0” or “FULL SCALE” as a value in the 5 Point Linear Calibration program.



LINEAR POINT 1 CALIBRATION

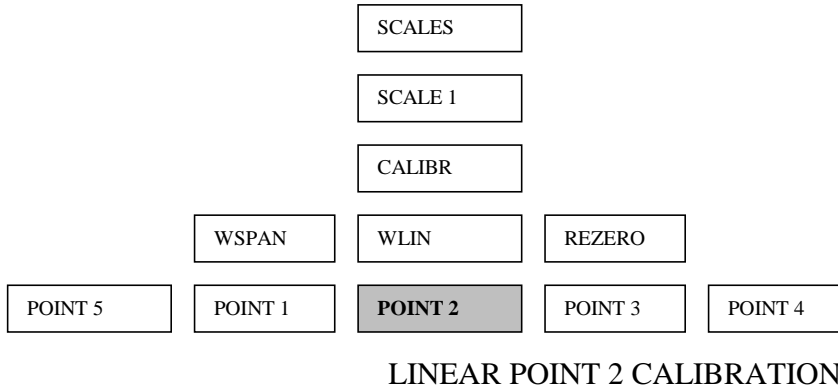
Step 6: Press the Down Arrow key. The number in the highlight box represents the A/D count for point 1.



LINEAR POINT 1 CALIBRATION

Step 7: Advance the machine until you have a load applied to the machine that is equal to the number keyed in as point 1. Press the “CALIBRATE” soft key located along the bottom of the display. The display will say “CALIBRATING” LINEAR POINT 1. The number displayed in the highlighted box represents the new A/D count for point 1.

Step 8: Press the Up Arrow key 2 times until “Point 1” is highlighted. Press the Right Arrow key to move to Point 2.



Step 9: Repeat steps 3 through 8 to set points 2, 3, 4 and 5.

Note: “0” and FULL SCALE cannot be used in the 5 Point Linear Calibration Program.

Step 10: After all 5 point have been stored, press the Up Arrow key until “SCALE 1” is highlighted, then press the “SAVE AND EXIT” soft key along the bottom of the display.

Step 11: To verify calibration accuracy, load machine to specific load points and compare the reading on the Indicator with those of the load cell standard. To improve accuracy you can adjust any linear point up or down. Refer back to steps 3 and 4. Adjust the settings under “WGT 1” by slightly increasing or decreasing the value.

Note: If “0” is reset in the span calibration, the 5-point linear calibration will be erased.

STATEMENT OF WARRANTY

Test Mark Industries warrants all new testing machines, testing apparatus and supplies manufactured by Test Mark Industries against defects in workmanship and materials for a period of 24 months from the original date of shipment, provided the equipment has been properly installed, maintained and operated in accordance with installation and operating instructions. This limited and exclusive remedy does not cover normal wear and tear. The Test Mark Industries manufactured product must be free from accident, damage by fire, water or act of God to be eligible for warranty.

Test Mark Industries will repair, replace or credit at Test Mark Industries' option defective product or component parts. When repair can be accomplished by exchange of a component part, the customer may be required to remove the part of modular component and install the exchanged part.

Warranty does not cover expenses, either direct or indirect, that may arise from the use or the inability to use Test Mark Industries products, or the secondary owner in the event of resale.

Products not manufactured by Test Mark Industries will carry the warranty of the original manufacturer. Under no circumstances shall Test Mark Industries be liable for any injury, loss, or damages, whether direct or indirect, incidental or consequential, arising out of the use of, or inability to use the products described herein.

This exclusion of liability for loss or damages, whether direct or indirect, incidental or consequential, shall apply to all claims whether sounding in contract, warranty, tort including both negligence and strict liability, or any other basis of liability.